

Leaf Classification



Purpose

Students will learn to classify (sort) a group of objects into different groups (classes). Students will learn about hierarchical classification systems. These fundamental concepts will help students better understand the MUC scheme used in the GLOBE *Land Cover and Accuracy Assessment Protocols*.

Overview

Students will gather an assortment of leaves from the school. As a group, they will develop their own classification system for sorting leaves, and will learn that there are different ways to classify the same group of objects. This activity introduces the complexity of a “simple” task for which there are no truly correct answers.

Time

One class period

Level

All

Key Concepts

Classification helps us organize and understand the natural world.

A classification system is a set of labels and rules used to sort objects.

A hierarchical system has multiple levels of increasing detail.

Skills

Creating a classification scheme

Using the scheme to organize objects

Beginning: *Sorting and grouping* objects

Intermediate: *Using labels and rules in classifying* objects

Advanced: *Using detailed labels and rules in classifying* objects

Materials and Tools

A variety of different leaves

Chalk board or large paper for classification scheme outline

Preparation

Collect a variety of different leaves.

Prerequisites

None

Background

Scientists classify many features of our environment such as clouds, soil types, or forest types. These classifications help us organize and understand the natural world. A *classification system* is an organized scheme for grouping objects into similar categories. There are two components to a classification system: *labels and rules*. The labels are the titles of the different classes in the classification system; the rules are the tests you apply to decide in which class to place an object. Well-defined labels and rules allow scientists to consistently describe and organize objects. For example, the Modified UNESCO Classification System used in the

GLOBE protocols allows GLOBE participants to consistently describe the land cover at any point on earth using the same labels and rules as all the other GLOBE participants.

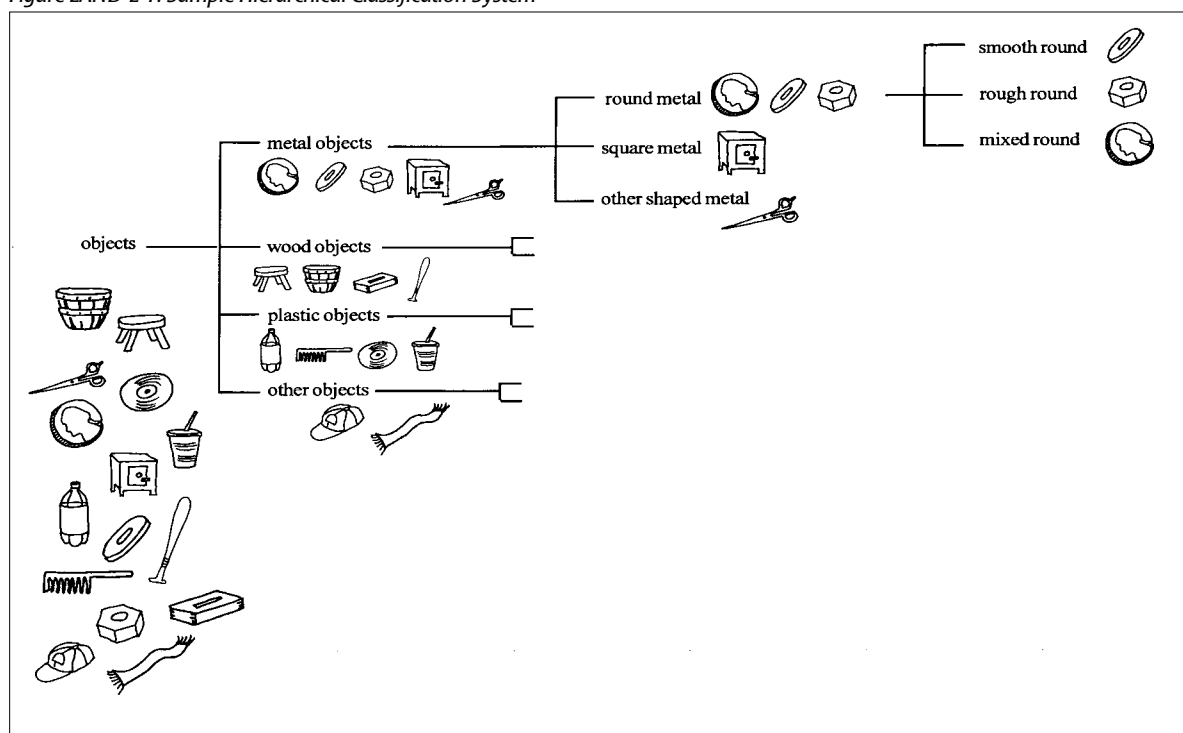
There are several key characteristics of all good classification systems. First, the classes must be *mutually exclusive* - that is, any object must have only one appropriate class in which it can be placed. If a classification system could place a leaf in either of two categories, then the classes are not mutually exclusive. Second, the classification system must be *totally exhaustive* - that is, there must be an appropriate class for all potential objects. This is frequently achieved by having a catch-all class such as “other”. If you have a leaf

for which there is no appropriate class, then the classification system is not totally exhaustive, and it must be modified, usually by adding at least one more class.

Finally, a classification system should be *hierarchical*. There should be multiple levels of increasing detail. At any level of detail, all the different classes should be able to “collapse” into the next (less detailed) level of the classification

system. Figure LAND-L-1 is an example of a hierarchical classification system of objects to illustrate: level one classes are metal objects, wood objects, plastic objects, and objects of other materials; level two classes within metal objects are round metal objects, square metal objects, and other shaped metal objects; level three classes within square metal objects are smooth surfaces, rough surfaces, and mixed surfaces; and so on.

Figure LAND-L-1: Sample Hierarchical Classification System



What To Do and How To Do it

1. Gather a collection of leaves (and bunches of needles) to be sorted into groups - get as many, and as many varieties as possible. Even try to get brown (old) and green (fresh) leaves. Try to make sure there are several conifer and deciduous varieties as well as plant or shrub leaves. If you live in a grassland area, you could use grasses or other herbaceous ground cover.
2. Gather the class in a circle. In the center, on the floor or on a table, spread out all of the leaves.
3. Instruct the students that they have to sort (classify) all of the leaves into groups of

similar types. Using a chalkboard to list suggestions, have the students suggest different characteristics that could be used for sorting the leaves. Discuss the difference between labels and rules. Discuss which characteristics are most important - or just have the students vote to decide the order of importance. They should realize that there is not necessarily one correct way. Classification systems are somewhat arbitrary, governed only by what we think makes sense. At the end of this step, you should have several characteristics, in hierarchical order of importance and generality, to be used for sorting the leaves.



Variation: Divide the class into groups and have each perform this step working independently. Then compare the classification systems and discuss the results.

4. Explain to the students that this hierarchical group of characteristics is a classification system. Scientists use classification systems to classify just about everything they encounter in the natural world: animals; trees; clouds; soils; and groups of vegetation associations, e.g., forest, desert, and meadow. Refer to the Accuracy Assessment pre-protocol learning activities for examples of bird and cloud classification.
5. Have the students sort the leaves using the chosen labels and decision rules. As the students sort the leaves, they may find that the classification system has to be modified or refined. This happens frequently in scientific projects. If there is time, students can use several different classification systems for sorting the leaves.

Discussion Questions

1. Why is it important that a classification system be exhaustive, mutually exclusive, and hierarchical?
2. How is it possible that there is no one “correct” classification system for leaves?
3. Do the user’s objectives affect the classification system which would be used?
4. Is a more detailed classification system better?

Variations

You can use various assortments of natural or unnatural objects for this exercise. Many things work well. It is useful to use leaves especially with younger students, so that students are comfortable distinguishing conifer and deciduous leaves and needles from each other.

Student Assessment

Assuming that students have participated in an activity “debriefing” using the discussion questions above, they should be able to accomplish the following:

1. Describe the design of their classification system, including the basis for the labels they use to establish different classes of leaves.
2. List rules or decision criteria they use for assigning each leaf to its class.
3. Describe how they structured the hierarchical system.
4. Have classified all of the leaves they collected using their system.

Each level of learners (beginning, intermediate, advanced) is likely to explain their approach using increasingly complex or detailed information and criteria.

The ultimate measure of student’s understanding of how classification systems are constructed and used will be the ease with which students are able to use the Modified UNESCO Classification System (MUC).

To determine whether students have grasped the concepts of developing a classification system have them review by answering the following questions:

1. What is a classification system?
2. What labels did you use to identify different classes of leaves?
3. What rules (criteria) did you use to assign each leaf to its class?
4. What are the levels of your classification system?
5. Are all of your leaves identified by assigning them to a class using the multiple layers of your system?